REMARKS

With this Amendment, Claims 8-23 and 25-30 are pending in the present application.

Obviousness under 35 U.S.C. § 103

Claims 8-23 and 25-30 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamamoto et al. (US6,265,782) in view of Shiobara et al. (US 5,166,228), Shi et al. (US 6,746,896) and Ishikawa et al. (US 5,248,853). The Examiner asserted that it would have been obvious to substitute a phenolic resin (as taught by Shiobara, Ishikawa and Shi) for the die attach layer of Yamamoto.

Applicant respectfully disagrees with the Examiner's characterizations of the cited references. Applicant submits that the Examiner has employed improper hindsight by arbitrarily selecting properties from disparate and incompatible materials and teachings of the prior art using Applicant's own claims as a roadmap. Applicant respectfully submits that there is no suggestion, either explicit or implicit, in the prior art to make the proposed combination, and in fact, Yamamoto teaches away from making such a combination.

With respect to Claims 8-23 and 25-30, the Examiner asserted that Yamamoto teaches all the limitations of the claims except for a die attach layer with a modulus of elasticity of less than about 106 ppm/°C or which is an epoxy modified with an elastomeric material (as recited by Claim 11). To cure this deficiency, the Examiner cites disparate teachings of phenolic resins from three additional references (Shiobara, Ishikawa and Shi) and asserts that it would have been obvious to substitute a phenolic resin into the structure of Yamamoto in place of the insulating adhesive taught therein.

The Examiner asserted that Shiobara teaches "that an epoxy modified with an elastomeric material is a phenolic resin (see col. 6, lines 29-35)." Column 6, lines 29-35 of Shiobara actually states:

> For the purpose of imparting a low coefficient of linear expansion, low modulus of elasticity and moisture resistance to the epoxy resin composition of the invention, silicone-modified epoxy ***or*** phenolic resins are desirably blended. The silicone-modified epoxy ***or*** phenolic resins used herein are preferably polymers obtained by reacting an alkenyl group-containing epoxy ***or*** phenolic resin with an organic silicon compound of the general formula...

The Examiner is apparently interpreting the word "or" in the above passage to mean "in other words." However, the context of this passage makes clear that "silicone-modified

epoxy" and "phenolic resin" are offered as alternatives rather than as different names for the same composition (which they are not). Moreover, the terms "phenolic" and "epoxy" identify entire classes of resin materials which can be formulated and even combined to form materials having a wide range of material properties. The question is not whether such materials *could* be formulated, but whether an ordinarily skilled artisan would have found it obvious to use an adhesive having the claimed properties in a circuit package as claimed.

The Examiner also asserted that a phenolic resin has a modulus of elasticity of 60 kg/mm^2 (i.e. 85.3 ksi) as evident in Ishikawa at col. 13, lines 1-7 and col. 14 lines 1-2. The Examiner apparently misread the cited portion of Ishikawa, because the cited section actually teaches a "Young's Modulus of not more than 450 kg/mm^2" (i.e. 639 ksi). Elsewhere, Ishikawa teaches that the modulus of the "buffer layer" is "not less than 200 kg/mm^2" (i.e. 284 ksi: see col. 2, line 25, 26). Thus, the materials taught by Ishikawa only underscore the fact that phenolic resins *can be* formulated to create materials with a very wide range of physical properties, but the finite range of elastic modulus recited in Applicant's independent Claims 15, 21 and 25 cannot be said to be inherent in such a broad class of materials. Such broad and generic teachings are not sufficient to render Applicant's claims obvious.

The Examiner further asserted that an epoxy modified with an elastomeric material has a coefficient of thermal expansion of about 64 ppm/°C as evident from Shi in Table 2, line 7 and Col 12, lines 38-56. However, the epoxy identified in Shi also has a very high modulus of elasticity of 2.4 GPa (i.e. 384 ksi). Thus, an ordinarily skilled artisan would not have considered using the material of Shi in place of the adhesive of Yamamoto, because Yamamoto requires a material with a storage elastic modulus at 25 °C of between 10 MPa and 2.0 GPa. Furthermore, Shi does not teach an epoxy modified with an elastomeric material, unless the definition of the word "elastomeric" is interpreted so broadly as to be meaningless. Claim 5 of Shi (at col. 12, lines 36-44) recites a material comprising "an epoxy resin; an organic curing hardener, a latent curing catalyst, a fluxing agent, and a filler." Applicant respectfully submits that none of these components is described in Shi or is otherwise known as an "elastomer" within the normal definition of that word.

The Examiner also asserted that "Yamamoto and Shiobara have substantially the same environment of a material have roughly the same modulus of elasticity that used with a

semiconductor device. [sic]" The Examiner concludes that it would have been obvious "to substitute the phenolic resin for the die attach layer of Yamamoto, since the phenolic resin provides excellent adhesion, low moisture uptake, low CTE, and controllable curing characteristics." Applicant respectfully disagrees and submits that an ordinarily skilled artisan would not have found it obvious to substitute the "adhesive layer" of Yamamoto with the encapsulant material taught by Shiobara, at least because Yamamoto teaches away from such a combination and the prior art of record does not provide a sufficient motivation to overcome this teaching-away.

The Examiner asserted that Yamamoto discloses a die attach layer with a modulus of elasticity of 600 MPa to 700 MPa. Applicant respectfully submits that Yamamoto contains no explicit teaching of this narrow range. Rather, Yamamoto states that the adhesive layer (1) has "a storage elastic modulus at 25 °C of from 10 to 2,000 MPa and a storage elastic modulus at 260 °C of from 3 to 50 MPa... and preferably 1,000 MPa or below...preferably from 50 to 1,500 MPa and most preferably from 100 to 1,000 MPa." (col. 6, line 66 - col. 8, line 4). In fact, a substantial portion of the disclosure of Yamamoto is dedicated to discussions of the importance of these properties of the adhesive layer materials.

Therefore, Applicant submits that Yamamoto teaches away from any substitution of the "insulating adhesive" material described therein. Based on the teachings in Yamamoto, an ordinarily skilled artisan would not have replaced the "insulating adhesive" layer of Yamamoto with any material that had not been shown to meet the strict requirements of having both a storage elastic modulus at 25 °C of 10 to 2,000 MPa ***and*** a storage elastic modulus at 260 °C from 3 to 50 MPa. Applicant notes that, not only does Shiobara teach a material belonging to a different functional category (i.e. an encapsulant rather than an adhesive layer), but there is no suggestion in Shiobara that would lead one to believe that the epoxy resin taught therein would have a storage elastic modulus at 260 °C from 3 to 50 MPa.

Applicant notes that Shiobara only suggests using the epoxy resin described therein as an encapsulant and not as an adhesive layer in a BGA package such as those described in Yamamoto. Applicant further notes that an encapsulant serves a substantially different function in a chip package, and therefore requires a substantially different set of properties. Thus, while the resin of Shiobara may provide "excellent adhesion, low moisture uptake, low

CTE, and controllable curing characteristics" as an encapsulant material, there is no reason to believe that such benefits would be achieved (or would even be similarly beneficial) if one were to use this material as an adhesive layer in the BGA package of Yamamoto. Furthermore, there is no reason to believe that Shiobara's resin would be superior to Yamamoto's adhesive in any of these respects to such a degree that an ordinarily skilled artisan would consider making such a substitution. Therefore, a person having ordinary skill in the art would not consider replacing the insulating adhesive material of Yamamoto with the encapsulant material of Shiobara.

In view of the above discussion, Applicant respectfully submits that the teachings of the prior art of record, taken alone or in combination, are not sufficient to render Applicant's claims obvious. Thus, Applicant respectfully requests that the rejections be withdrawn.

CONCLUSION

The undersigned has made a good faith effort to respond to all of the rejections and objections in the present application and to place the claims into condition for allowance. Nevertheless, if any issues remain which can be resolved by telephone, the Examiner is respectfully requested to call Applicant's representative at the number indicated below in order to resolve such issues promptly.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 12/15/04

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